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Revision : **0**

ENGINEERING DESIGN FILE

SUBCONTRACT NO. **SOO-588051**

PROJECT FILE NO. **020978**

OLIVE AVENUE STORM WATER LIFT STATION AT INTEC

INEEL
Idaho National Engineering & Environmental Laboratory
BECHTEL BWXT IDAHO, LLC

Form 412.14
10/05/99
Rev. 02

PROJECT FILE NO.	020978
EDF SERIAL NO.	EDF-1379
FUNCTIONAL FILE NO.	N/A

ENGINEERING DESIGN FILE

PROJECT/TASK OU 3-13 Group 1 - Tank Farm Interim Action Phase 1 & 2

SUBTASK Lift Station

EDF PAGE NO. 1 OF 24

TITLE OLIVE AVENUE STORM WATER LIFT STATION AT INTEC

SUMMARY

The Waste Area Group 3, Operable Unit 3-13 Record of Decision (ROD) for the Group 1 - Tank Farm Interim Action requires installation of engineering controls to reduce water infiltrating into the contaminated tank farm soils. This Interim Action includes upgrading the existing storm water runoff collection system in the tank farm including a 150-ft drainage control zone around the tank farm and constructing a lined evaporation pond where storm water runoff from the INTEC facility will be collected. The ROD requires the storm water collection system to accommodate a 25-year 24-hour storm event.

This EDF summary is for the design of the storm water lift station to be located at the intersection of Olive Avenue and Beech Street inside INTEC. This area forms a low spot, and pumping is required to prevent flooding. The maximum design flow determined for the 25-yr storm event is 1230 gpm. Normal operating conditions will be flow from the 2-yr storm determined to be 603 gpm. The pumps are sized for one pump operation under normal conditions (2-yr storm event) with both pumps operating simultaneously during maximum design flows (25-yr event). The length of pressure pipe is approximately 400 ft with a head loss of 17 feet.

The floor of the lift station was set at elevation 4899.5 to allow for storage and depth required for an existing storm drain line to be connected to the lift station. The depth of the existing drain line had to be maintained because of the utility tunnel running east to west down Olive Avenue. The existing storm drain flows into a drywell that will be filled with concrete. The drywell will now function as a catch basin. Based on this information, the overall depth of the lift station will be 15.8 feet deep with a 10 ft diameter precast concrete structure, see attachments.

Thrust blocks were analyzed for the discharge piping using EBAA Iron Inc. restrained length calculation program. The analysis indicated that thrust blocks were not required provided mechanically restrained joints were used at bends and within five lineal feet of bends. EBAA data analysis sheets are attached to this EDF.

AUTHOR

PROFESSIONAL ENGINEER REGISTERED 9404 9/18/00 STATE OF IDAHO KURT D. FRITZ

Kurt D. Fritz

DISTRIBUTION (COMPLETE PACKAGE):

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BBWI Review	DATE	BBWI Review	DATE

ENGINEERING DESIGN FILE

PROJECT FILE NO. 020978

EDF SERIAL NO. EDF-1379

FUNCTIONAL FILE NO. N/A

PROJECT/TASK OU 3-13 Group 1 - Tank Farm Interim Action Phase 1 & 2

SUBTASK Lift Station

SUMMARY (Continued)

References:

1. Wastewater Pump Catalogs and H20 Optimize **99** software by Hydromatic Pumps.
2. Engineering Design File Sewage Lift Station Required at TRA, Clint Kingsford, EDF-346, **1995.**
3. Pipe-Flo Engineering Software, Version 6.08, Engineered Software, Inc., Lacey, WA, **1997.**
4. Highway Drainage Guidlines. Storm Drainage Systems, Dan Ghere et al., **1987.**
5. DOE-ID, **1999,** ***Final Record of Decision for the Idaho Nuclear Technology and Engineering Center, OU3-13 at the Idaho National Engineering Laboratory,*** USDOE-ID, USEPA, IDHW, DOE-ID-10660, October.
6. EBAA Iron Inc. Restrained Length Calculation Program, Version **3.1,** Eastland, TX.

Conclusions:

The piping system was analyzed using both hand calculations and Pipe-Flo software. The hand calculations were performed to check the analysis of Pipe-Flo, however, the software lended better results as the dual pump system operation was able to be analyzed. Using Pipe-Flo, the systems resistance curve was developed for proper pump selection and sizing.

In summary, a 10 ft diameter wet well 15.8 feet deep is recommended with two 7.5 hp submersible pumps. An 8" diameter force main will be required in order to limit the head loss in the pipeline and keep velocities to acceptable levels. Calculation and data sheets are attached.

DESIGN VOLUME: 1230 gpm = Q_{in} (25-yr STORM)
603 gpm = Q_{in} (2-yr STORM)

ASSUME: CONTINUOUS OPERATION AT PEAK FLOW PUMP

WET WELL SIZE:

PIPE OUT ELEVATION: 4907
LOW LEVEL PROBE: 4901
6 ft of STORAGE

WET WELL AVAILABLE IN 8', 10', AND 12' DIAMETER

ASSUME 8' ϕ:

$V = \pi r^2 h = \pi (4)^2 (6) = 301.6\ ft^3 \rightarrow 2256$ gal

10' ϕ:

$V = \pi (5)^2 (6) = 471\ ft^3 \rightarrow$ 3523 gal

12' $\phi \rightarrow 5075$ gal

NORMAL OPERATION WILL REQUIRE ONE PUMP. THE 25 YR STORM OCCURRENCE WILL REQUIRE BOTH PUMPS TO OPERATE. THE 2-YR STORM EVENT WAS CHOSEN AS A MEASURE OF A NORMAL PRECIPITATION EVENT.

Vol = 3523 gal

Cycle time $\frac{3523\ gal}{603\ gal/min} = 5.84$ min

CHECK VELOCITY IN PIPE

PEAK FLOW → 1230 GPM (BOTH PUMPS ON)

4" ϕ Pipe; AREA = $0.087\ ft^2$

FLOW = $\dfrac{1230\ gal/min}{448.8} = 2.74\ ft^3/sec$

VEL = $\dfrac{2.74\ ft^3/sec}{0.087\ ft^2} = 31.5\ ft/sec$

6" ϕ Pipe; AREA = $0.196\ ft^2$

VEL. = $\dfrac{2.74\ ft^3/sec}{0.196\ ft^2} = 13.95\ ft/sec$ ←

8" ϕ Pipe; AREA = $0.349\ ft^2$

VEL = $\dfrac{2.74\ ft^3/sec}{0.349\ ft^2} = 7.85\ ft/sec$

NORMAL FLOW → 603 GPM (ONE PUMP OPERATION)

FLOW = $\dfrac{603\ gal/min}{448.8} = 1.34\ ft^3/sec$

4" ϕ Pipe; VEL = $\dfrac{1.34\ ft^3/sec}{0.087\ ft^2} = 15.4\ ft/sec$

6" ϕ Pipe; VEL = $\dfrac{1.34\ ft^3/sec}{0.196\ ft^2} = 6.86\ ft/sec$ ←

8" ϕ Pipe; VEL = $\dfrac{1.34\ ft^3/sec}{0.349\ ft^2} = 3.85\ ft/sec$

NORMAL OPERATION WILL CONSIST OF ONE PUMP OPERATING.

TRY 6" ϕ PIPE.

TOTAL HEAD REQUIRED:

The total head required is based on pipe friction loss, minor losses, elevation from pump to outlet at discharge point.

STATIC HEAD

ELEV. @ DISCHARGE: 4913.0
ELEV. @ PUMP BOTTOM: 4900.25
12.75 ft ←

SINGLE PUMP OPERATION:

LOSSES IN PIPE (DARCY-WEISBACH)

$$h_f = f\frac{L}{D}\left(\frac{V^2}{2g}\right)$$ where $\varepsilon = 0.000005$ for new PVC

$$\frac{\varepsilon}{D} = \frac{.000005}{0.5} = 0.00001$$

$$R = \frac{VD}{\nu}$$ water @ 60°F $\nu = 1.217 \times 10^{-5}\ ft^2/sec$

$$= \frac{(6.86\ ft/sec)(0.5\ ft)}{1.217 \times 10^{-5}\ ft^2/sec} = 2.8 \times 10^5$$

FROM MOODY DIAGRAM
$f = 0.015$ $L = 370\ ft$

$$\therefore h_f = 0.015\frac{(370\ ft)(6.86\ ft/sec)^2}{0.5\ ft(2)(32.2\ ft/sec^2)} = 8.1\ ft$$ ←

VELOCITY HEAD: $K V^2/2g$

SINGLE PUMP: $\frac{(6.86\ ft/sec)^2 K}{2(32.2\ ft/sec^2)} = 0.73\ ft * K$

MINOR LOSSES	do.	K VALUE	TOTAL
90° BEND	4	0.45	1.8
CHECK VALVE	1	1.5	1.5
WYE	1	0.5	0.5
45° BEND	6	0.24	1.44
22.5° BEND	2	0.20	0.4
SUDDEN ENLARGE	1	0.60	0.6
EXIT LOSS	1	0.50	0.5
			6.74

VELOCITY HEAD $h_L = 0.73\text{ ft}(7) = 5.11\text{ ft}$

TOTAL HEAD $= 12.75 + 8.1 + 5.1 = \underline{\underline{26.0\text{ ft}}}$

DUAL PUMP OPERATION

LOSSES IN PIPE

$$R = \frac{VD}{\nu} = \frac{(13.95\text{ ft/sec})(0.5\text{ ft})}{1.217\times10^{-5}\text{ ft}^2/\text{sec}} = 5.7\times10^5$$

FROM MOODY DIAGRAM:

$f = 0.013 \qquad L = 370\text{ ft}$

$$\therefore h_f = \frac{0.013(370\text{ ft})(13.95\text{ ft/sec})^2}{0.5\text{ ft}(2)(32.2\text{ ft/sec}^2)} = 29.1\text{ ft}$$

VELOCITY HEAD

BOTH PUMPS: $\dfrac{(13.95\text{ ft/sec})^2}{2(32.2\text{ ft/sec}^2)} = 3.02\text{ ft} * K$

ADDITIONAL K COEFFICIENTS

MINOR LOSS	No.	K	TOTAL
90° BEND	2	0.45	0.9
CHECK VALVE	1	1.5	1.5
			2.4 + 6.7 = 9.1

$h_L = 3.02\text{ ft}(9.1) = 27.5\text{ ft}$

TOTAL HEAD $= 12.75 + 29.1 + 27.5 = \underline{\underline{69.3}}\text{ ft}$

PUMP SELECTION

$$Whp = \frac{gpm \times H \times spgr}{3960} = \frac{(603)(27)(1)}{3960} = 4.11 \text{ hp}$$

ASSUME
EFF PUMP: 75%
EFF MOTOR: 80%

$$\frac{4.11}{(.75)(.8)} = 6.85 \text{ hp}$$

DUAL PUMP OPERATION

$$Whp = \frac{1230(69)(1)}{3960} = 21.4 \text{ hp}$$

$$\frac{21.4}{(.75)(.8)} = \underline{35.7 \text{ hp}} \quad \text{too large} \longleftarrow$$

TRY 8" ϕ PIPE

STATIC HEAD = 12.75 ft

VELOCITY HEAD;

SINGLE PUMP: $\frac{(3.85 \text{ ft/s})^2 K}{2(32.2)} = 0.23 K = 6.74(.23) = \underline{1.55 \text{ ft}}$

DUAL PUMP: $\frac{(7.85)^2 K}{64.4} = 0.96 * K = 0.96(9.1) = \underline{8.7 \text{ ft}}$

LOSSES IN PIPE

SINGLE: $\frac{e}{D} = \frac{.000005}{.67} = 7.5 \times 10^{-6}$

$$R = \frac{VD}{\nu} = \frac{(3.85)(.67)}{1.217 \times 10^{-5}} = 2.1 \times 10^{5}$$

FROM MOODY DIA:
$f = 0.0155$ $\quad$ $L = 370$ ft

$$\therefore h_f = \frac{0.0155(370)(3.85)^2}{.67(2)(32.2)} = 1.97 \text{ ft}$$

TOTAL HEAD = $12.75 + 1.55 + 1.97 = \underline{\underline{16.3 \text{ ft}}}$

DOUBLE PUMP

$$\frac{\varepsilon}{D} = 7.5 \times 10^{-6}$$

$$R = \frac{VD}{\nu} = \frac{(7.85)(.67)}{1.217 \times 10^{-5}} = 4.3 \times 10^{5}$$

FROM MOODY: $f = 0.014$

$$\therefore h_f = \frac{.014(370)(7.85)^2}{.67(2)(32.2)} = 7.4 \text{ ft}$$

TOTAL HEAD: $12.75 + 8.7 + 7.4 = \underline{\underline{28.8 \text{ ft}}}$

PUMP SELECTION

Single: $\dfrac{603(16.3)(1)}{3960} = \dfrac{2.48}{.75(.8)} = 4.1 \text{ hp}$

Dual: $\dfrac{1230(28.8)(1)}{3960} = \dfrac{8.95}{.75(.8)} = 14.9 \text{ hp}$

HAND CALCS DO NOT SUFFICIENTLY ANALYZE THE SYSTEM'S RESISTANCE UNDER DUAL PUMP OPERATION. THEREFORE, PIPE-FLO WILL BE USED TO DEVELOP THE SYSTEM'S RESISTANCE CURVE TO DEFINE THE TOTAL HEAD LOSS UNDER DUAL PUMP OPERATION.

WITH PIPE-FLO, AN ITERATIVE PROCESS WAS USED TO DETERMINE THE PROPER PUMP SELECTION.

IN SUMMARY, SINGLE PUMP OPERATION WOULD DELIVER APPROXIMATELY 1000 GPM @ 14' OF HEAD. DUAL PUMP OPERATION WILL DELIVER APPROX. 1355 GPM @ 17' OF HEAD USING TWO 5 H.P. PUMPS.

OU3-13 Group 1
Olive Ave. Lift Station

PUMP-FLOver: 6.04
02/25/00

PUMP DATA SHEET
HYDROMATIC

Curve: S6A870

Selection file: KURT1230.UFS
Catalog: HYDRO60.MPC v 2

n Point: Flow: 920 US gpm
Head: 14 ft

Pump: NCLOG-6 - 900 Speed 870 rpm
Size: S6A/S6AX Dia: 10.25 in

Limits: Temperature: 140 "F Pressure: 125 ps_g^i
Sphere size: 3.75 in Power: --- bhp

Specific Speed: Ns: --- Nss: ---

Dimensions: Suction: --- in Discharge: 6 in

Motor: 5 hp Speed 900 Frame: 254T
NEMA Standard TEFC Enclosure
sized for Max Power on Design Curve

Fluid: Water
Temperature: 60 °F
SG: 1
Viscosity: 1.122 cP
Vapor pressure: 0.2568 ps_a^i
Atm pressure: 12.5 ps_a^i

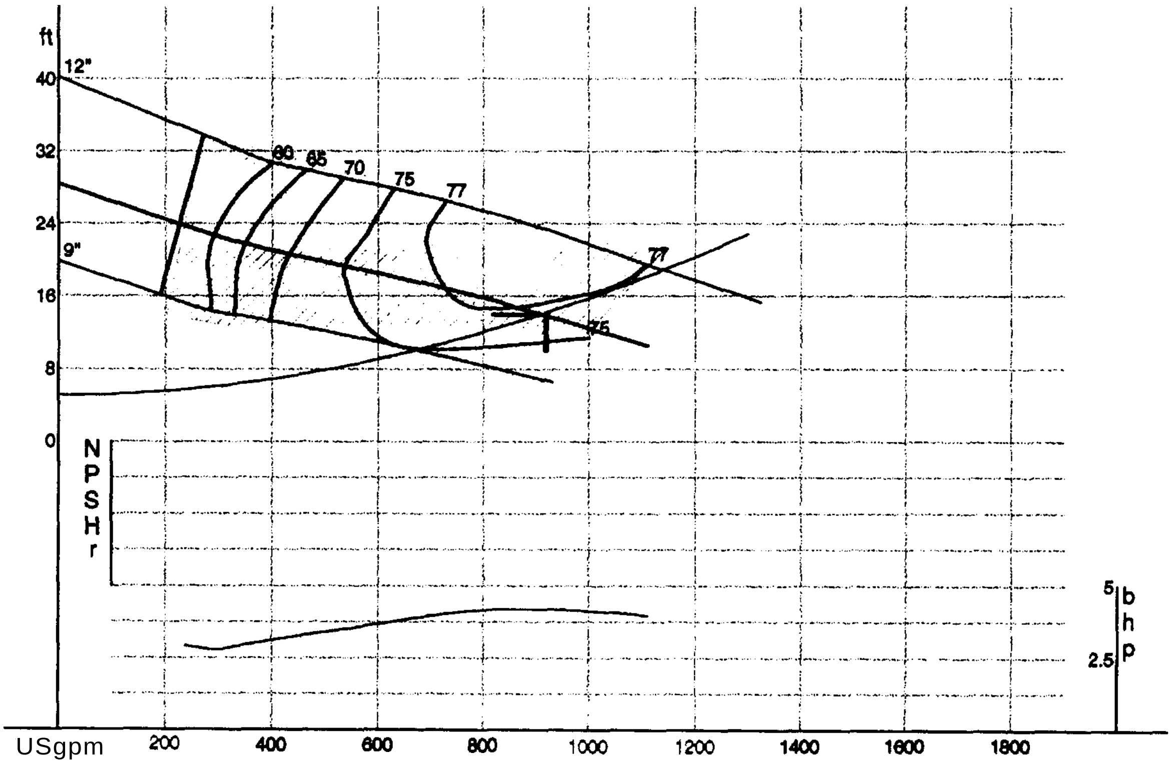
NPSHa: -- ft

Piping: System: FRITZ.PLL
Suction: --- in
Discharge: --- in

— Data Point —
Flow: 920 US gpm
Head 13.8 ft
Eff: 76%
Power: 4.14 bhp
NPSHr: - ft

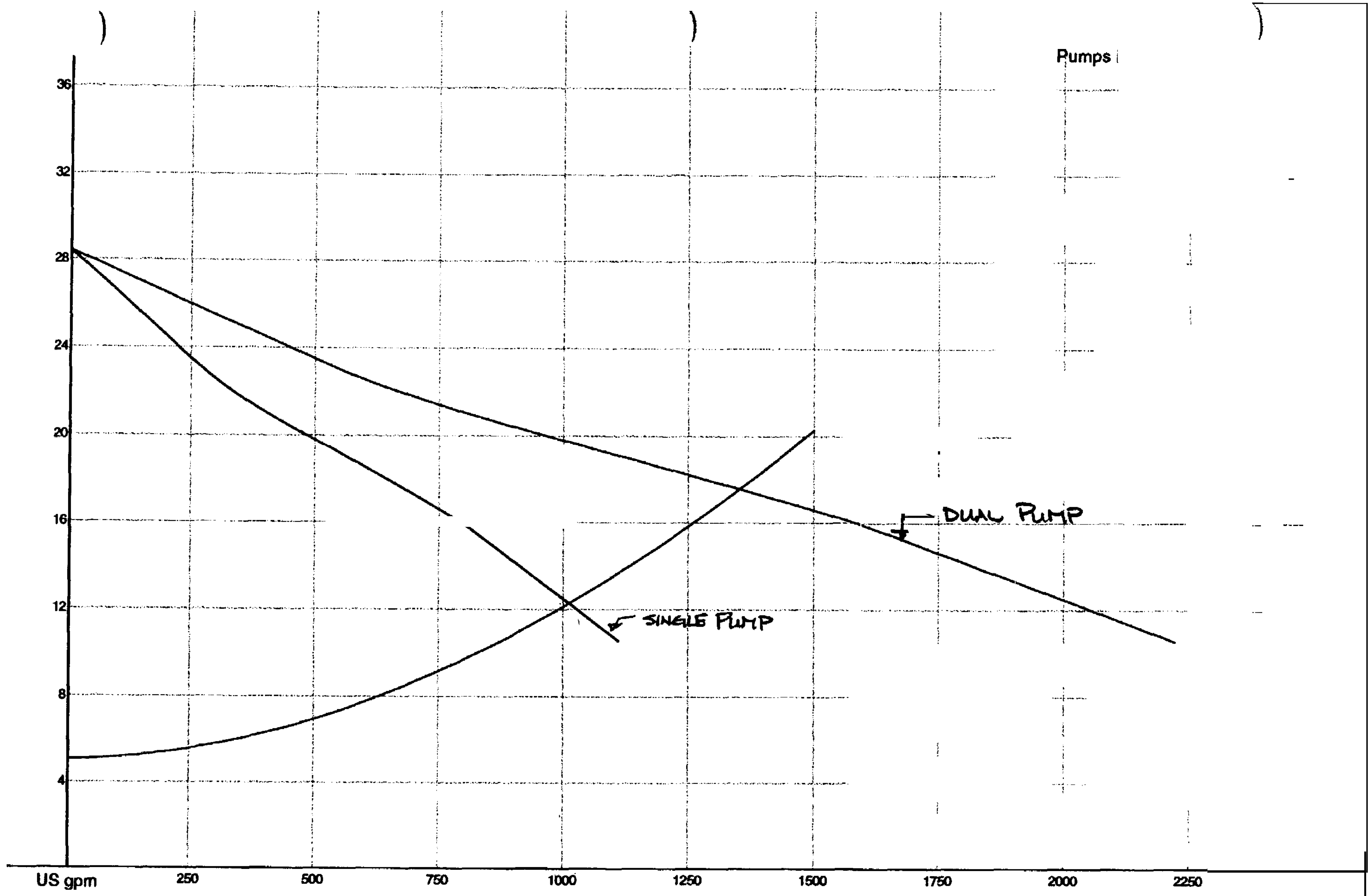
- Design Curve -
Shutoff Head: 28.4 ft
Shutoff dP: 12.3 psi
Min Flow: 239 US gpm
BEP: 77% eff
@ 795 US gpm
NOL Pwr: 4.19 bhp
@ 864 USgpm

-- Max Curve —
Max Pwr: 7.11 bhp
@ 1112 US gpm



— PERFORMANCE EVALUATION —

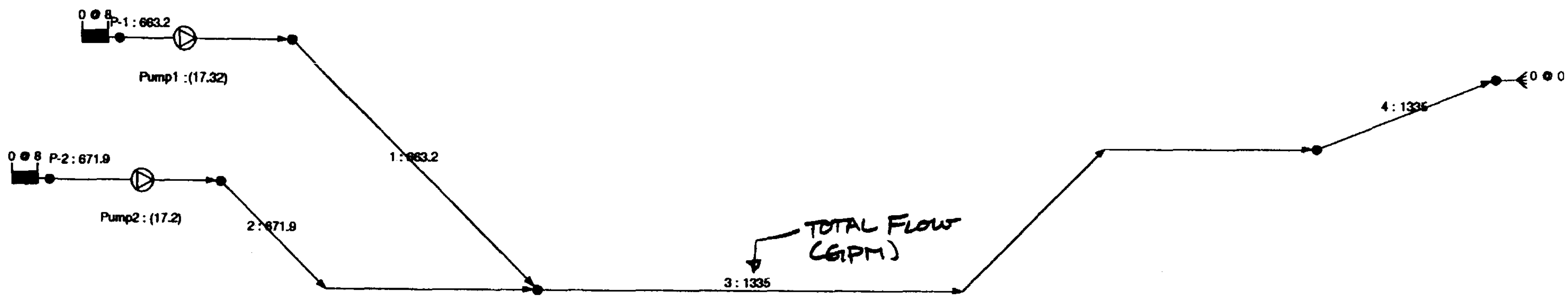
Flow US gpm	Speed rpm	Head ft	Pump %eff	Power bhp	NPSHr ft	Motor %eff	Motor kW	Hrs/yr	Cost /kWh
1104	870	10.7	75	3.98	---				
920	870	13.8	76	4.14	---				
736	870	16.8	77	4.04	---				
552	870	19.1	75	3.54	---				
368	870	21.5	66	3.02	---				



INEEL - INTEC Lift Station	HYDROMATIC	NCLOG-6 - 900
Kurt Fritz - PE	Catalog: HYDRO60.MPC, vers 2	Size: S6A/S6AX
03/07/00	Curve: S6A870	Speed: 870 rpm
Selection file: KURT1230.UFS		Impeller: 10.25 in

PUMP FLO

10/24



Company:	INEEL	System:	FRITZ
by:		Nodes:	Pressures
Comments:	Olive AVe. Lift Station	**flow rate:**	US gpm
		pressure:	psi
Version:	PIPE-FLO *6.08* 03/07/00 2:19 pm	**level & grade:**	ft

PIPELIST REPORT

Lift Station

SPECIFICATIONS

SPECIFICATION	PIPE MATERIAL Sch / Roughnes	FLUID Temp / Pres	VALVE TABLE	DESIGN LIMITS Vel / Pres
01 Ductile rev: 02/15/00 5:18 pm	Ductile Iron Sch 4 0.0102 in Size for: 10 ft/sec	Water 60 °F 0 psi g	Standard	0 / 12 ft/sec -12.243 / 50 psi g
02 PVC rev: 02/15/00 5:19 pm	PVC Sch 40 6e-005 in Size for: 10 ft/sec	Water 60 °F 0 psi g	Standard	0 / 12 ft/sec -12.243 / 50 psi g

12/24

PIPELINE	SPEC	MATERIAL Sue / Sch	LENGTH ft	FLUID Temp / Pres	VALVES Total-K
1	02	PVC 8 in / 40	16.7	Water 60 °F / 0 psi g	2.236
2	02	WC 8 in / 40	17.2	Water 60 °F / 0 psi g	1.597
3	02	WC 8 in / 40	340	Water 60 °F / 0 psi g	1.516
4	02	PVC 12 in / 40	10	Water 60 °F / 0 psi g	2.816
P-1	01	Ductile Iron 6 in / 4	10	Water 60 °F / 0 psi g	1.338
P-2	01	Ductile Iron 6 in / 4	10	Water 60 °F / 0 psi g	1.338

Com[illegible] :Bechtel BWXT Idaho, LCC
[illegible]: OU3-13 Group 1
[illegible]: Kurt Fritz - PE

02/25/00 9:56 am
System: FRITZ
rev: 02/25/00 9:20 am

SYSTEM REPORT

Created: 02/15/00 5:07 pm
Design file:
Pipe Specs: 2

Pipes: 6
Nodes: 7
Pumps/Comps: 2

Lift Station

SYSTEM NODES

NODE	ELEVATION ft	PIPELINES IN	PIPELINES OUT
~N--001	4907.e	P-1	1
~N--002	4907.6	1 2	3
~N--003	4907.e	P-2	2
~N--004	4907.e	3	4
~N--005	4913	4	
~N--006	4900		P-1
~N--007	4900		P-2

14/24

PUMP COMP

PERFORMANCE DATA

Pump1

US gpm:	0	350	538	795	1111
ft:	28.4	21.8	19.3	16	10.6

eqn: 28.4 - 0.04479 Q ^ 0.8482

Selection: KURT1230 from Catalog: HYDRO60
Pump: NCLOG-6 S6A/S6AX at 870 rpm

Pump2

US gpm:	0	350	538	795	1111
ft:	28.4	21.8	19.3	16	10.6

eqn: 28.4 - 0.04479 Q ^ 0.8482

Selection: KURT1230 from Catalog: HYDRO60
Pump: NCLOGB S6A/S6AX at 870 rpm

15/24

Com y: Bechtel BWXT Idaho, LCC
t: OU3-13 Group 1
y: Kurt Fritz - PE

Created: 02/15/00 5:07 pm
Design file:
Pipe Specs: 2

02/25/00 9:56 am
System: FRITZ
rev: 02/25/00 9:20 am

Pipes: 6
Nodes: 7
Pumps/Comps: 2

MATERIALS REPORT

Lift Station

PIPE MATERIALS LIST

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
1	02	PVC 8 in / 40	16.7	1-Tee Flow Thru Branch 1-Reducer Enlargement 5 X 8
2	02	PVC 8 in / 40	17.2	1-Elbow *Short* - r/d 1 @ 45° 1-Reducer Enlargement 5 X 8
3	02	WC 8 in / 40	340	1-Tee Flow Thru Run 6-Elbow Short - r/d 1 @ 45°
4	02	PVC 12 in / 40	10	3-Elbow Short - rid 1 @ 45° 1-Reducer Enlargement 8 X 12 1-Exit Projecting
P-1	01	Ductile Iron 6 in / 4	10	2-Elbow *short* - r/d 1 @ 90° 1Swing Check Vertical
P-2	01	Ductile Iron 6 in / 4	10	2-Elbow short - r/d 1 @ 90° 1-Swing Check Vertical

16/24

PIPE MATER' SUMMARY

02/25/00 9:56 am
System: FRITZ

PIPE MATERIAL	SCHEDULE	SIZE	LENGTH
Ductile Iror	4	6in	20 ft
PVC	40	8in	373.9 ft
		12 in	10 ft

TOTAL SYSTEM VOLUME: 1061 gallons

VALVE & FITTING SUMMARY

SPECIFICATION	MATERIAL	SCHEDULE	VALVES & FITTINGS
01 Ductile	Ductile Iror	4	
	Size: 6 ir		4-Elbow Short - r/d 1 @ 90°
			2-Swing Check Vertical
02 PVC	W C	40	
	Size: 8 ir		I-Tee Flow Thru Branch
			2-Reducer Enlargement 5 X 8
			7-Elbow Short - r/d 1 @ 45°
			1-Tee Flow Thru Run
	Size: 12 ir		3-Elbow Short - r/d 1 @ 45°
			1-Reducer Enlargement 8 X 12
			1-Exit Projecting

17/24

Olive Avenue Lift Station

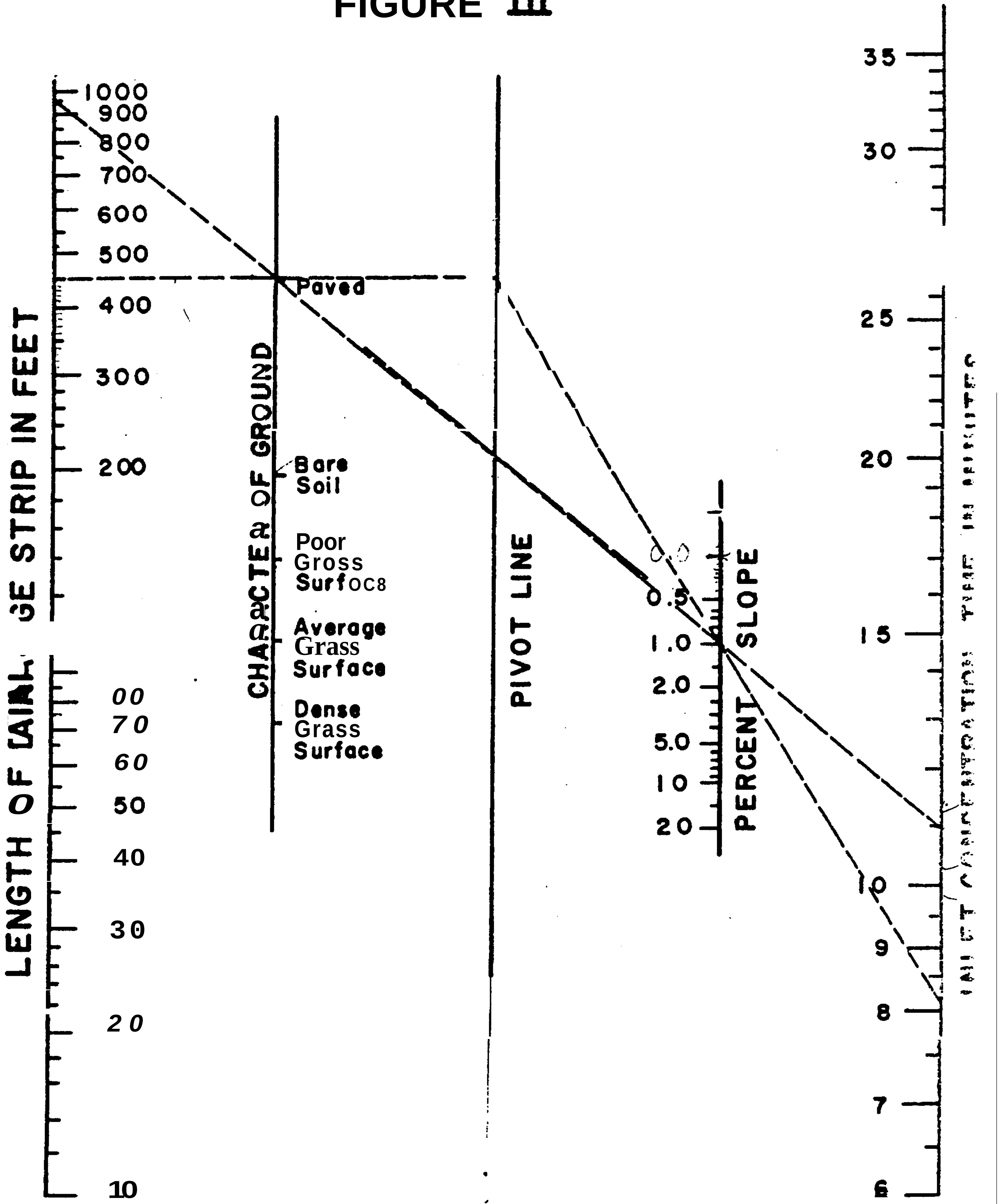
Sub-Area	Total Area	Area	Impervious		Pervious		Cimp	Cp	Cwt	CA
	ft^2	Acres	ft^2	Acres	ft^2	Acres				
A2 to LS										
B	70964	1.63	35482	0.81	35482	0.81	0.9	0.3	0.6	0.98
D	48611	1.12	36458.25	0.84	12152.75	0.28	0.9	0.3	0.75	0.84
	119575	**2.75**	**71940.25**	**1.65**	**47634.75**	**1.09**				**1.81**

	Tc (min)	I (in/hr)	A (acre)	CA	QT (cfs)	QT (gpm)
2-yr Storm	20	0.74	2.75	1.81	**1.34**	602.59
25-yr Storm	20	1.5	2.75	1.81	**2.72**	**1221.47**

3/18/00

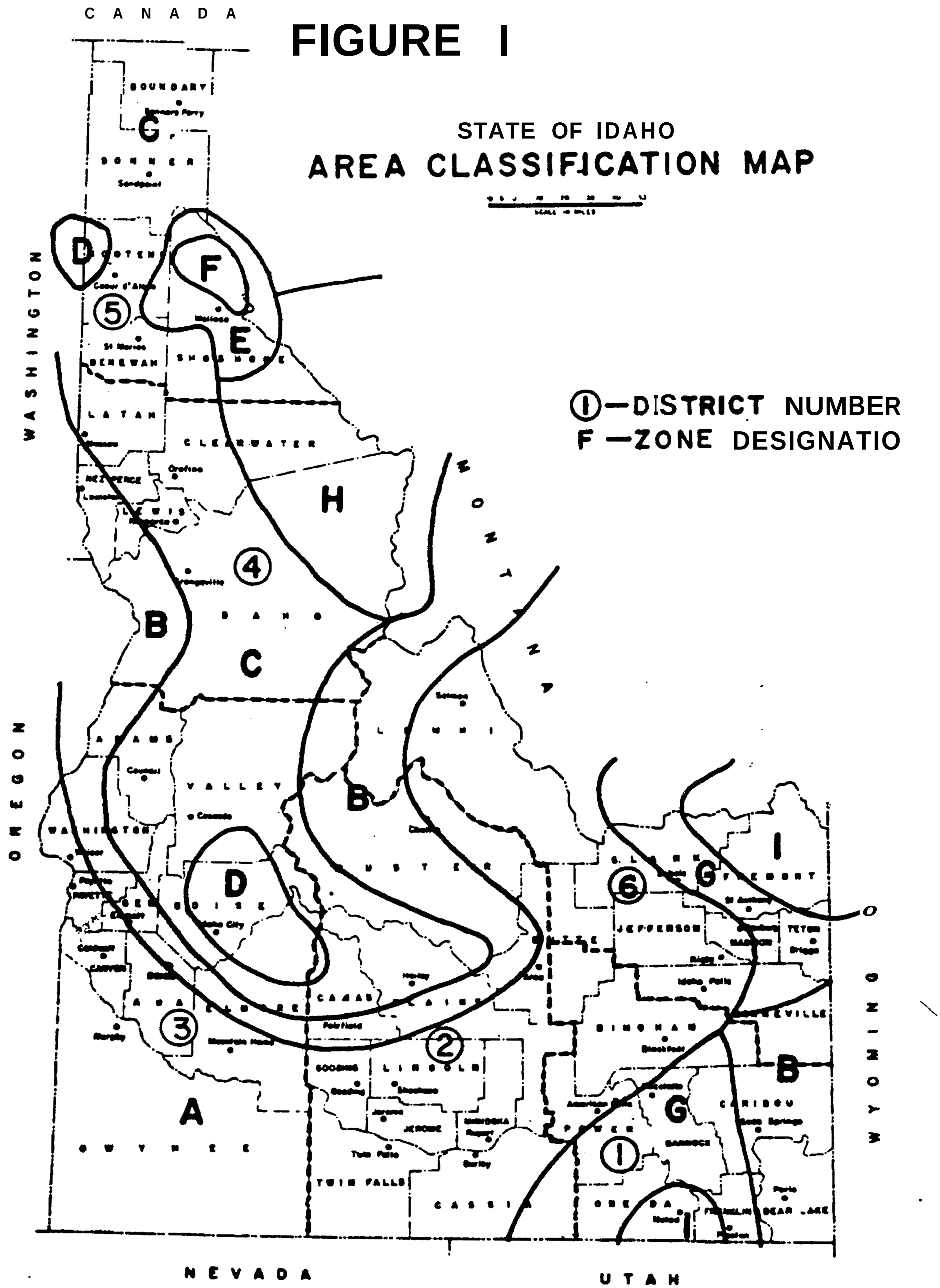
18/24

FIGURE III



OVERLAND FLOW TIME

FIGURE I


STATE OF IDAHO
AREA CLASSIFICATION MAP
①—DISTRICT NUMBER
F —ZONE DESIGNATIO
CANADA
WASHINGTON
OREGON
MONTANA
WYOMING
NEVADA
UTAH
BOUNDARY
BONNER
KOOTENAI
BENEWAH
SHOSHONE
LATAH
CLEARWATER
NEZ PERCE
LEWIS
IDAHO
ADAMS
VALLEY
WASHINGTON
LEMHI
CUSTER
BOISE
CLARK
FREMONT
JEFFERSON
MADISON
TETON
BINGHAM
CAMAS
LINCOLN
GOODING
JEROME
MINIDOKA
TWIN FALLS
CASSIA
POWER
BANNOCK
CARIBOU
BEAR LAKE
FRANKLIN
ONEIDA
OWYHEE
ELMORE
ADA
CANYON
A
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G
H
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1
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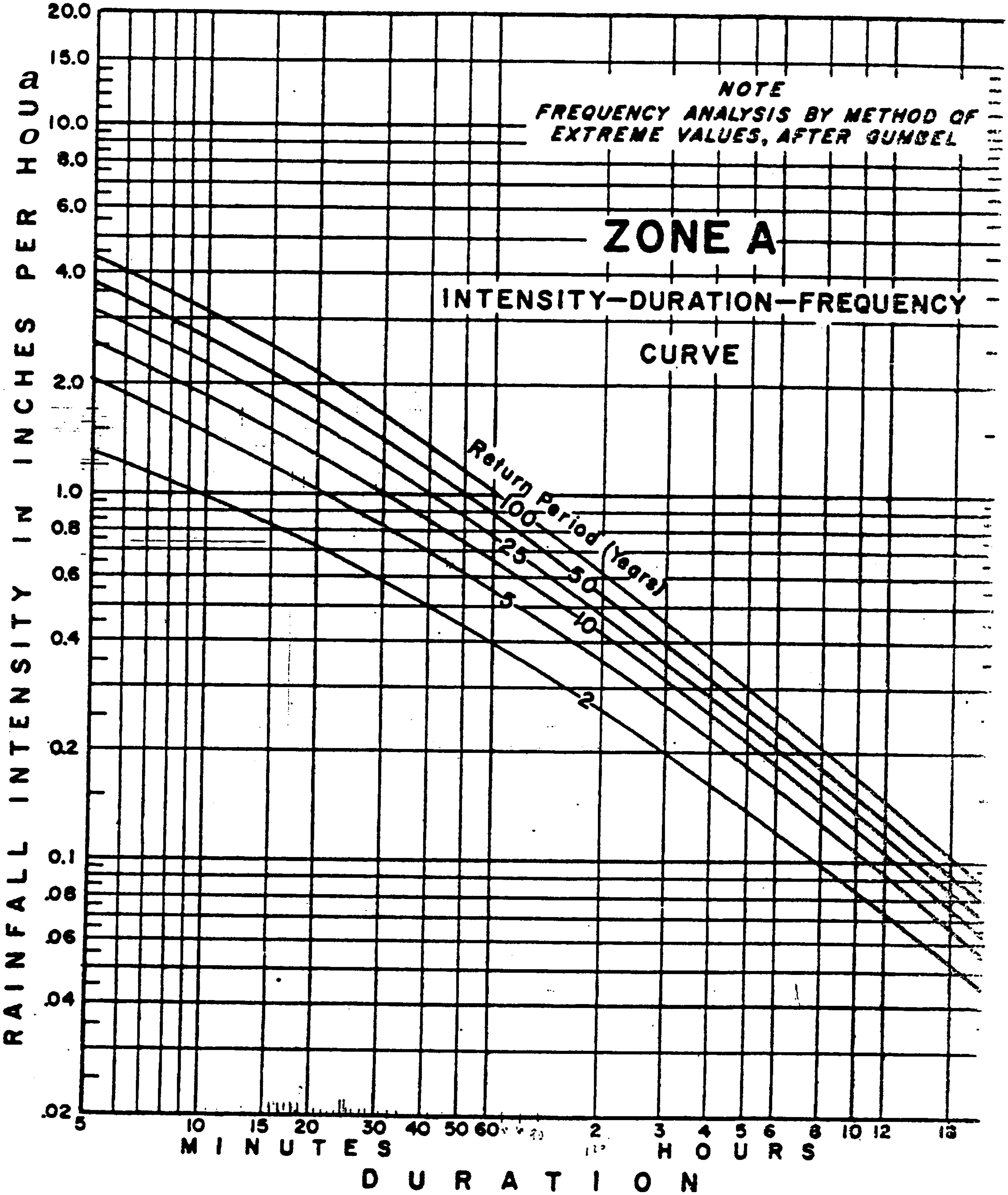
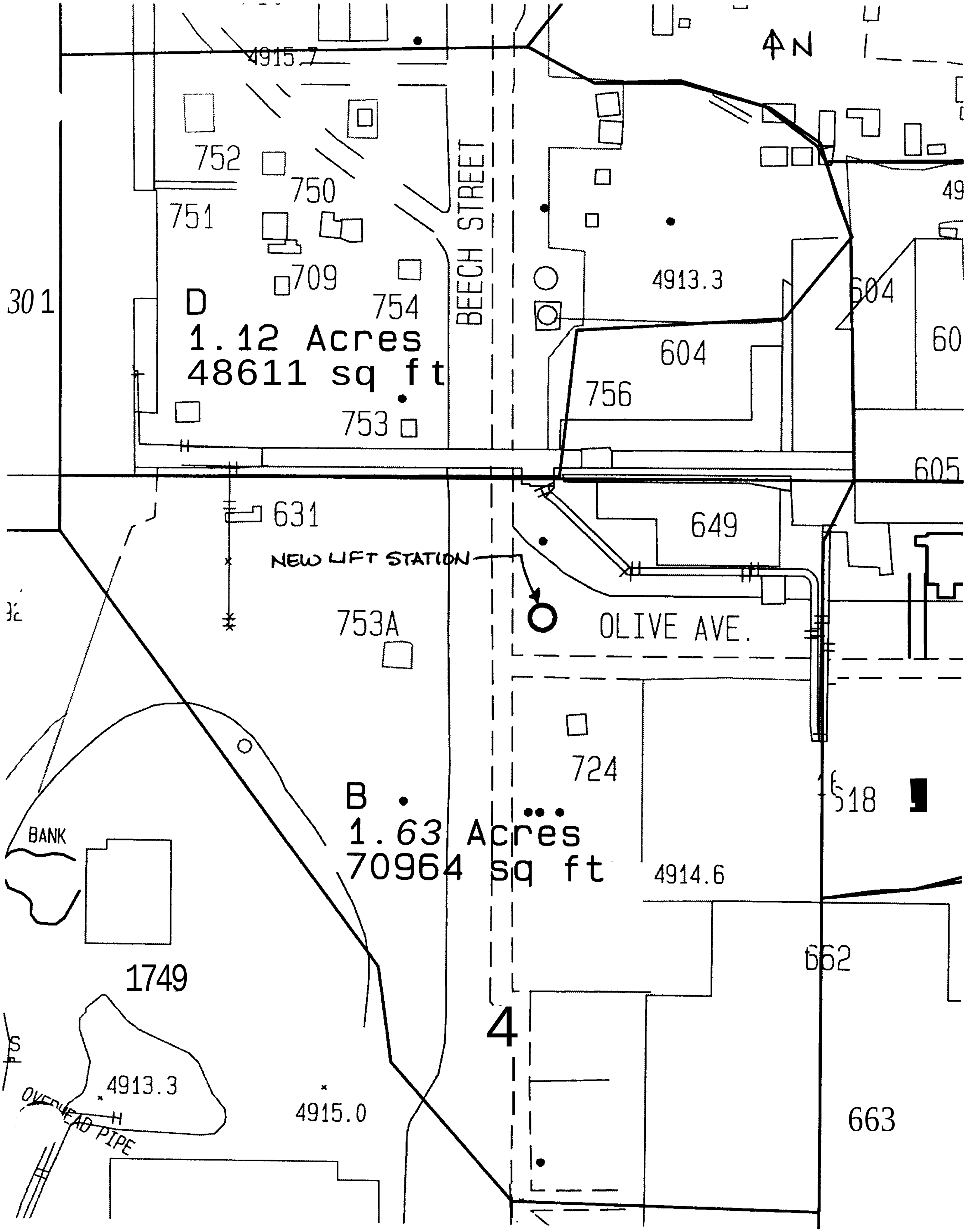
3
4
5
6

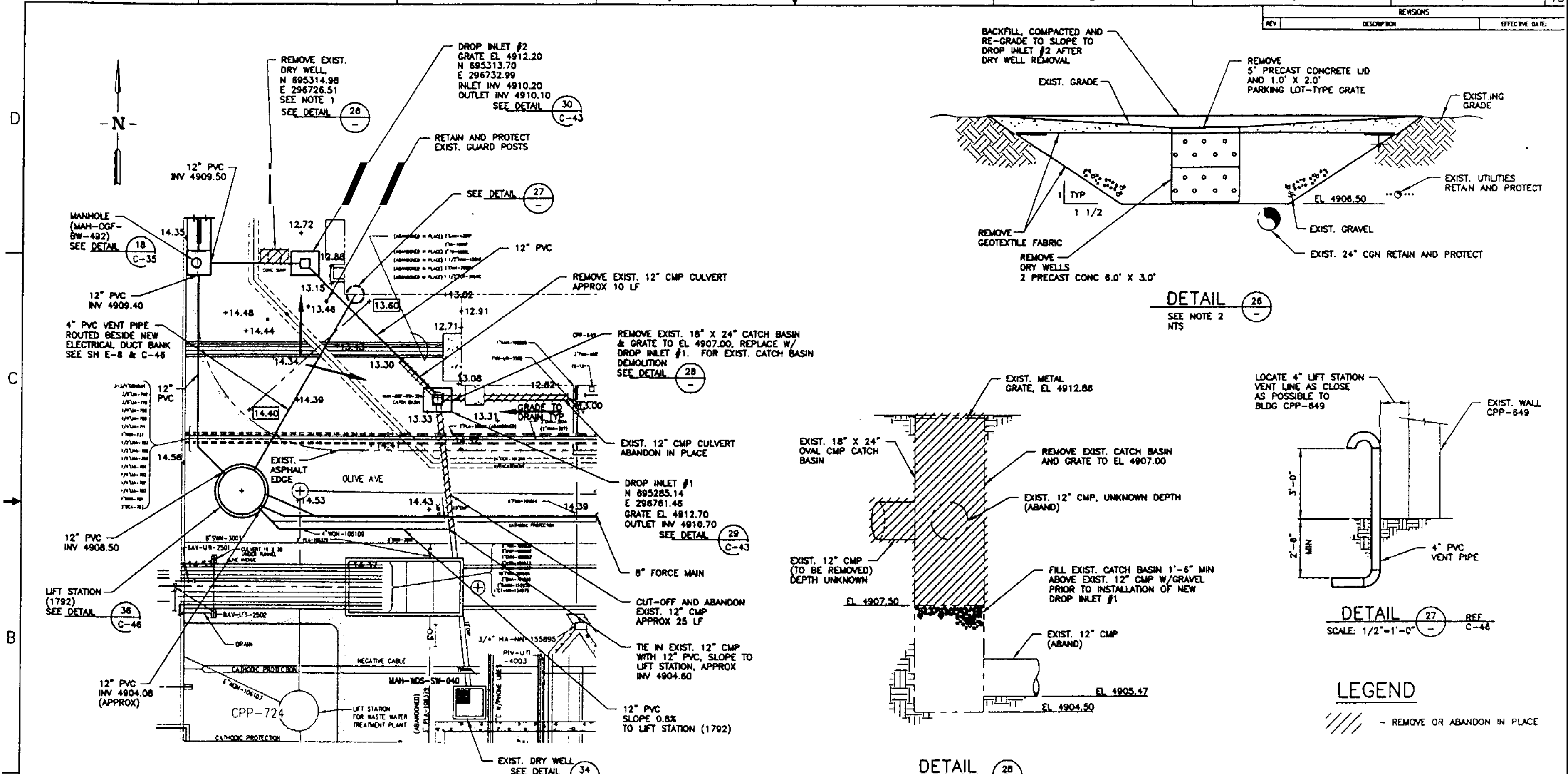
21/24

FIGURE I-A




N
4915.7
752
750
751
709
754
BEECH STREET
D
1.12 Acres
48611 sq ft
753
301
4913.3
604
604
756
49
60
605
631
649
NEW LIFT STATION
753A
OLIVE AVE.
724
518
B
1.63 Acres
70964 sq ft
4914.6
BANK
1749
662
4
4913.3
OVERHEAD PIPE
4915.0
663

23/24



ENLARGED PLAN REF C-1 C-3
SCALE: 1"=10.0'

NOTES

1. RETAIN AND PROTECT ALL EXISTING FOOTINGS, SLABS AND OTHER STRUCTURES, INCLUDING EXISTING OVERHEAD 42" DIA DUCT WITH 12.0' CLEARANCE.
2. RETAIN AND PROTECT ALL UNDERGROUND UTILITIES.
3. ADD 4900 TO ALL ELEVATIONS POINTS SHOWN.

REVISION: 0
ORIGINAL SIGNED BY: KURT D. FRITZ
DATE ORIGINAL SIGNED: 9/18/2000
SEAL NUMBER: 9404
ORIGINAL STORED AT: CROB DOCUMENT CONTROL

PROFESSIONAL ENGINEER REGISTERED 9404 STATE OF IDAHO KURT D. FRITZ

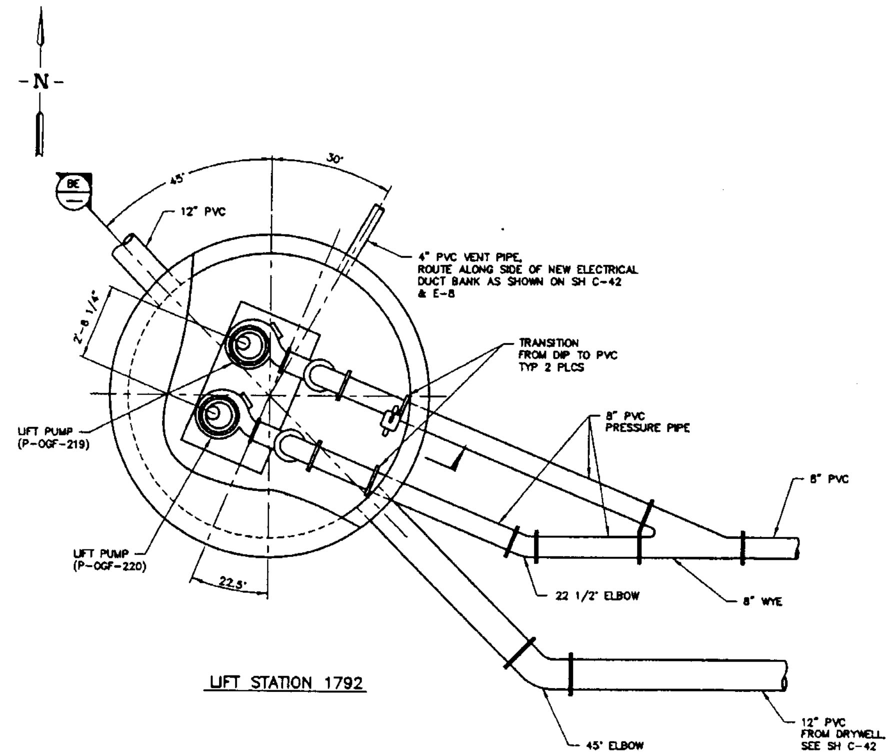
FOR DRAWING INDEX SEE DRAWING NO.	515158
SUBCONTRACT NO.	S00-588051
REQUESTER	M.S. KAPTEIN
DESIGN	KURT FRITZ
DRAWN	ROB HERGESHEIMER
PROJECT NO.	020978
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	68366
DESIGN PHASE	AFC
QUALITY LEVEL	3
EFFECTIVE DATE	9/18/2000

INEEL
OU 3-13 GROUP 1
TANK FARM INTERIM ACTION
PHASE 1 & 2
ENLARGED PLAN AND DETAILS

SIZE D | AREA 200 | TYPE 0100 | CL 65 | DISC 090 | DWG-515201 | SHEET C-42 | SCALE NOTED

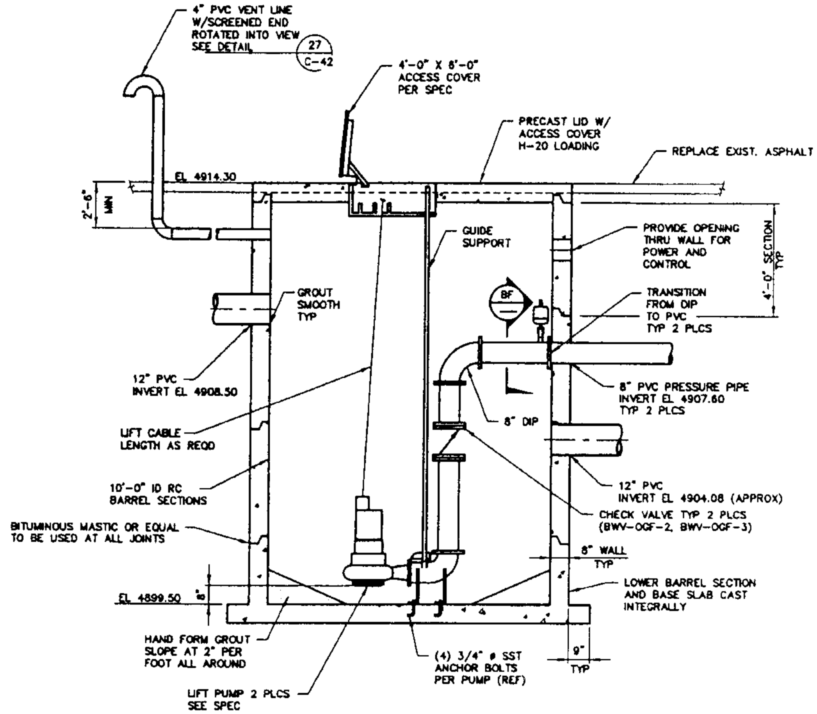
REVISIONS: REV | DESCRIPTION | EFFECTIVE DATE

45



LIFT STATION 1792

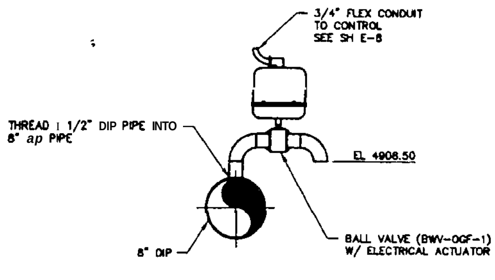
DETAIL 36/C-3
SCALE: 1/2"=1'-0"
REF. C-4, C-11, C-12, C-42



SECTION BE
SCALE: 1/2"=1'-0"

LIFT STATION 1792 CONTROL SETTINGS

HIGH LEVEL ALARM	EL 4909.00
PUMPS ON (BOTH)	n 4908.00
FIRST PUMP ON	n 4907.00
PUMPS OFF (BOTH)	n 4m.m



SECTION BF
SCALE: 1 1/2"=1'-0"

NOTES

1. PUMPS, GUIDE RAILS, ANCHOR BOLTS AND ACCESS COVER SHALL BE LOCATED WITH RESPECT TO EACH OTHER AS PER MANUFACTURER'S INSTALLATION INSTRUCTIONS AND DRAWINGS.

REVISION: 0
ORIGINAL SIGNED BY: KURT D. FRITZ
DATE ORIGINAL SIGNED: 9/18/2000
SEAL NUMBER: 9404
ORIGINAL STORED AT: EROB DOCUMENT CONTROL

PROFESSIONAL ENGINEER REGISTERED 9404 STATE OF IDAHO KURT D. FRITZ

FOR DRAWING INDEX SEE DRAWING NO. 515158
SUBCONTRACT NO. S00-588051
REQUESTER: M.S. KAPTEIN
DESIGN: KURT FRITZ
DRAWN: ROB HERGESHEIMER
PROJECT NO. 020978
SPEC CODE
SCALE: 1/2" = 1'-0"
SCALE: 1 1/2" = 1'-0"
DESIGN PHASE: AFC
QUALITY LEVEL: 3
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO. 88366
EFFECTIVE DATE: 9/18/2000

INEEL
INEEL
OU 3-13 GROUP 1
TANK FARM INTERIM ACTION
PHASE 1 & 2
LIFT STATION SECTIONS AND DETAIL

SIZE	CAGE CODE	AREA	TYPE	Q	DISC	DWG-	REV
D		200	1792	60	090	515205	

SCALE: NOTED
SHEET C-46

49

Attachment [redacted] to EDF-I379

EBAA Data Analysis Sheets

The Design of Restrained Piping Systems

Q: Can the use of restrained joints eliminate the need for thrust blocks and rods'!

A: Yes.

In a properly designed restrained piping system, the use of thrust blocking and rodding can be completely eliminated.

When a pipeline undergoes a change of direction o a change of diameter, an unbalanced hydrostatic force is generated. Thrust blocking acts to resist this force by distributing it over a relatively large area of soil behind the fitting. The thrust block pushes on the soil, the soil pushes back.

Rodding acts to resist this force by tying several fittings together such that the forces generated are canceled. One fitting pushes in one direction, the other fitting pushes with an equal force in the opposite direction.

In a properly designed restrained piping system, a sufficient length of pipe is "locked" together and thus acts as its own thrust block. When the joints between a group of fittings is restrained, the pipe wall perform the function of the rodding.

One of the key elements in restrained piping is the proper and conservative design of such systems. The design goal is to determine a length of pipe to be restrained such that the soil's passive resistance and frictional resistive forces are greater than the unbalanced hydrostatic force. This length, combined with an appropriate factor of safety provides a conservative and economical method of pipeline desig

Although the number of combinations of fittings is beyond the scope of this program, combinations can often be simplified to one of the common fitting types. This is done by specifying restraint on all of the joints within the combination and then examining the axial force vectors along each length of pipe. In some cases many of the forces are canceled and the fittings can b treated as a group and calculation can proceed simila to an individual fitting.

For additional information on the design of restrained joint piping systems, contact EBAA Iron Sales and request "Connections" bulletins PD-1 through PD-6.

Project Name TFIA

Piping Materials

Installation Conditions

Soil Type	GM
Trench Type	5
Test Pressure	50 psi.
Safety Factor	1.5 to 1
Depth of Bury	6 ft.
Low Side Depth	8 ft.

Click here to review Fs and Rs values.

Fs, Rs

Restrained Length Calculation Results:

Upper Bend Restrained Length = 5 ft.

Lower Bend Restrained Length = 1 ft.

Calculate

Clear

Exit

Project Name TFIA

Drawing Location Drawing C-12

Piping Materials

Pipe Material	PVC
Nominal Size	8"
Fitting Type	Horizontal Bend
Bend Angle	45°

Installation Conditions

Soil Type	GM
Trench Type	5
Test Pressure	50 psi.
Safety Factor	1.5 to 1
Depth of Bury	6 ft.

Click here to review Fs and Rs values.

Fs, Rs

Restrained Length Calculation Results:

length To Be Restrained = 2 ft.

Calculate

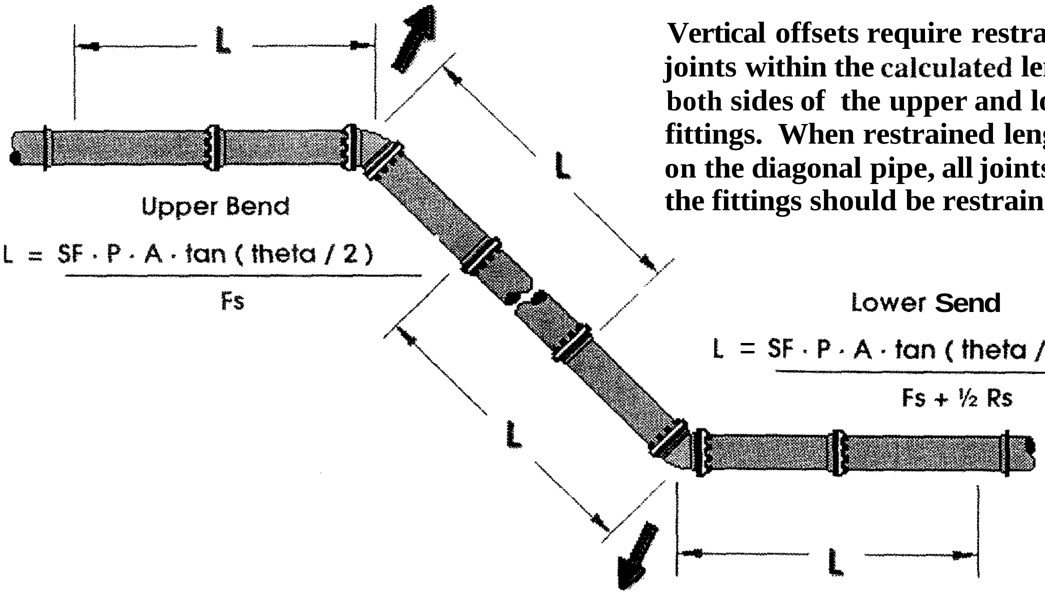
Clear

Exit

Vertical Offsets

Resultant Thrust (T) = 2 . P . A . sin (theta / 2)

Vertical offsets require restraint of all joints within the calculated lengths (L) on both sides of the upper and lower fittings. When restrained lengths overlap on the diagonal pipe, all joints between the fittings should be restrained.



Upper Bend

$$L = \frac{SF \cdot P \cdot A \cdot \tan(\theta / 2)}{Fs}$$

Lower Send

$$L = \frac{SF \cdot P \cdot A \cdot \tan(\theta / 2)}{Fs + \frac{1}{2} Rs}$$

Resultant Thrust (T) = 2 · P · A · sin (theta / 2)

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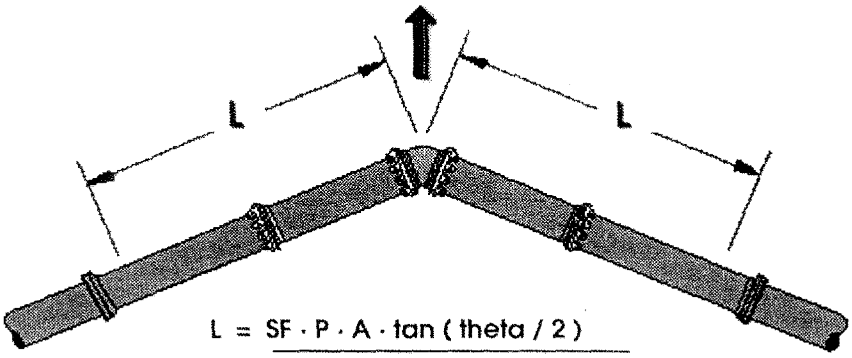
Horizontal Bends

Resultant Thrust $(T) = 2 \cdot P \cdot A \cdot \sin(\theta / 2)$



$$L = \frac{SF \cdot P \cdot A \cdot \tan(\theta / 2)}{Fs + \tfrac{1}{2} Rs}$$

Horizontal bends require restraint of all joints within the calculated length (L) on both sides of the fitting. In many cases, careful planning during installation can reduce the number of joints within the restrained length.

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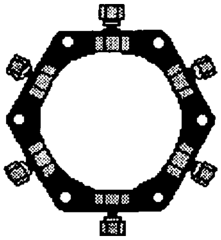

2000 PV Joint Restraint

Mechanical Joint Restraint for PVC Pipe

Application
- ☐ Ductile Iron Pipe
- ☑ PVC Pipe
- ☐ Steel Pipe 3" - 12"
- ☐ Gray Cast Iron Pipe

Product Description

The Series 2000 PV joint restraint for PVC pipe is the result of over a decade of testing, design, and experience in the restraint of PVC pipe. Positive restraint of the pipe is provided by the use of individually actuated gripping wedges which act to evenly distribute the thrust forces around the circumference of the pipe. This is a full range product line for use on all sizes of AWWA C-900 and C-905 PVC pipe and can also be used on IPS diameter PVC pipe in 3" - 12" sizes. In all cases, the pressure rating is equivalent to that of the pipe on which it is used. This restraint product meets the requirements of UNI-B-13, is listed by Underwriters Laboratories (4" - 12"), and is Factory Mutual approved (4" - 12"). Call and ask for Connections bulletins PV-1 and PV-2 concerning the testing of the 2000PV.

Related Products

The 2000PV is offered in a split version called the 2000SV, used to restrain existing PVC pipe. The series 1600, 2800, and 2500 PVC pipe bell restraints are often used with the 2000PV to satisfy restrained length requirements.

EBAA IRON

Please feel free to call for additional information or application assistance on these or other EBAA products.